

## **Historic, Archive Document**

Do not assume content reflects current scientific knowledge, policies, or practices.



# Boom and Bust in Energy Extraction

Edward J. Smith

Agriculture  
and Rural  
Economics  
Division



BOOM AND BUST IN ENERGY EXTRACTION. By Edward J. Smith. Agriculture and Rural Economics Division, Economic Research Service, U.S. Department of Agriculture, Washington, DC 20005-4788. May 1986. Staff Report No. AGES860423.

#### ABSTRACT

After oil prices peaked and began to recede in 1981, U.S. oil and gas extraction employment declined, moderately in some States and severely in others. Oil prices declined gradually from 1981 through 1985 mainly because of reduced demand, but precipitously in early 1986 because of increased supply. Because both supply and demand changes are likely to be temporary, the future price of oil is expected to be higher. However, current indications suggest that energy price increases may be less violent and disruptive than those since the 1972-73 oil embargo.

Keywords: Energy, employment, prices, production, energy extraction, energy outlook, nonmetro areas.

\*\*\*\*\*  
\* This report was reproduced for limited distribution to the \*  
\* research community outside the U.S. Department of Agriculture \*  
\*\*\*\*\*

#### CONTENTS

INTRODUCTION.....	1
PAST DEVELOPMENTS IN OIL AND GAS.....	1
PAST DEVELOPMENTS IN COAL.....	5
OUTLOOK FOR OIL AND GAS.....	7
OUTLOOK FOR COAL.....	9
OUTLOOK FOR NUCLEAR ENERGY.....	9
REFERENCES.....	10

# Boom and Bust in Energy Extraction

Edward J. Smith\*

## INTRODUCTION

The energy industries have been dominated by large cyclical changes in supply, demand, and price since the early 1970's. Will the energy sector continue to exhibit such instability in the future? This paper attempts to provide some insight into this question by examining past developments in the oil and gas industries and by synthesizing the results of several studies dealing with the future prospects for oil, gas, coal, and nuclear energy.

## PAST DEVELOPMENTS IN OIL AND GAS

The tenfold rise and subsequent fall in wholesale oil prices since the Organization of Petroleum Exporting Countries (OPEC) embargo of 1972-73 was accompanied by a sharp rise and subsequent decline in oil and gas extraction activity in the United States (fig. 1). The number of drilling rigs in operation more than tripled between 1973 and 1981 when oil prices peaked, rising from 1,194 to 3,970; that number then dropped to as low as 1,858 in June 1985 (7). 1/

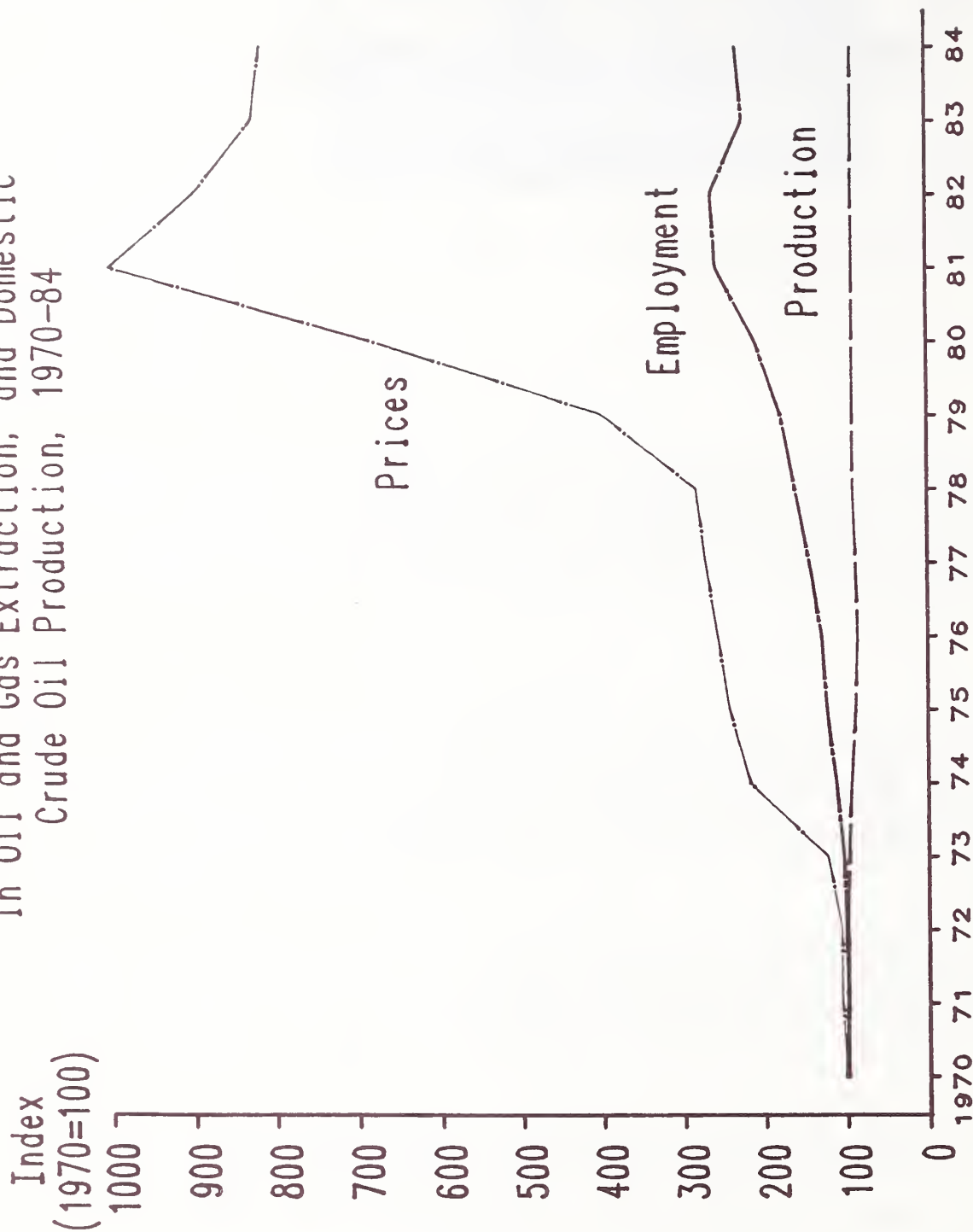
The number of new oil and gas wells drilled went from 27,700 to 90,100 in the 1973-81 period, then dropped to an annual rate of 75,300 in the first 6 months of 1985. The number of crews engaged in seismic exploration grew similarly in that period. In 1973, an average of 250 crews were at work in any given month; the 1981 average was 681, but only 392 in the first 6 months of 1985.

---

\* The author recently retired as an economist in the Agriculture and Rural Economics Division, Economic Research Service, U.S. Department of Agriculture.

1/ Underlined numbers in parentheses identify literature cited in the References.

Figure 1. Crude Oil Prices, Employment  
in Oil and Gas Extraction, and Domestic  
Crude Oil Production, 1970-84



Note: Natural gas production figures were quite similar to these for oil, but lower after 1981.

Source: U.S. Department of Energy and Bureau of Labor Statistics.

Total employment in oil and gas extraction jumped from 274,000 in 1973 to 708,000 in 1981 (up nearly 160 percent), then fell to just under 600,000 in May 1984 (down 16 percent) (9, fig. 1). While these are not very large numbers in terms of the total U.S. economy, they are quite important in the main producing States, particularly in the parts of those States where the oil and gas production is concentrated.

Despite the increased drilling activity, however, production did not increase. Oil production declined 13.8 percent in 1970-76, and stayed some 10 percent below the 1970 level through the late seventies and early eighties (fig. 1). Natural gas production showed a similar pattern through 1970-81, then dropped to 18 percent below the 1970 level in 1984.

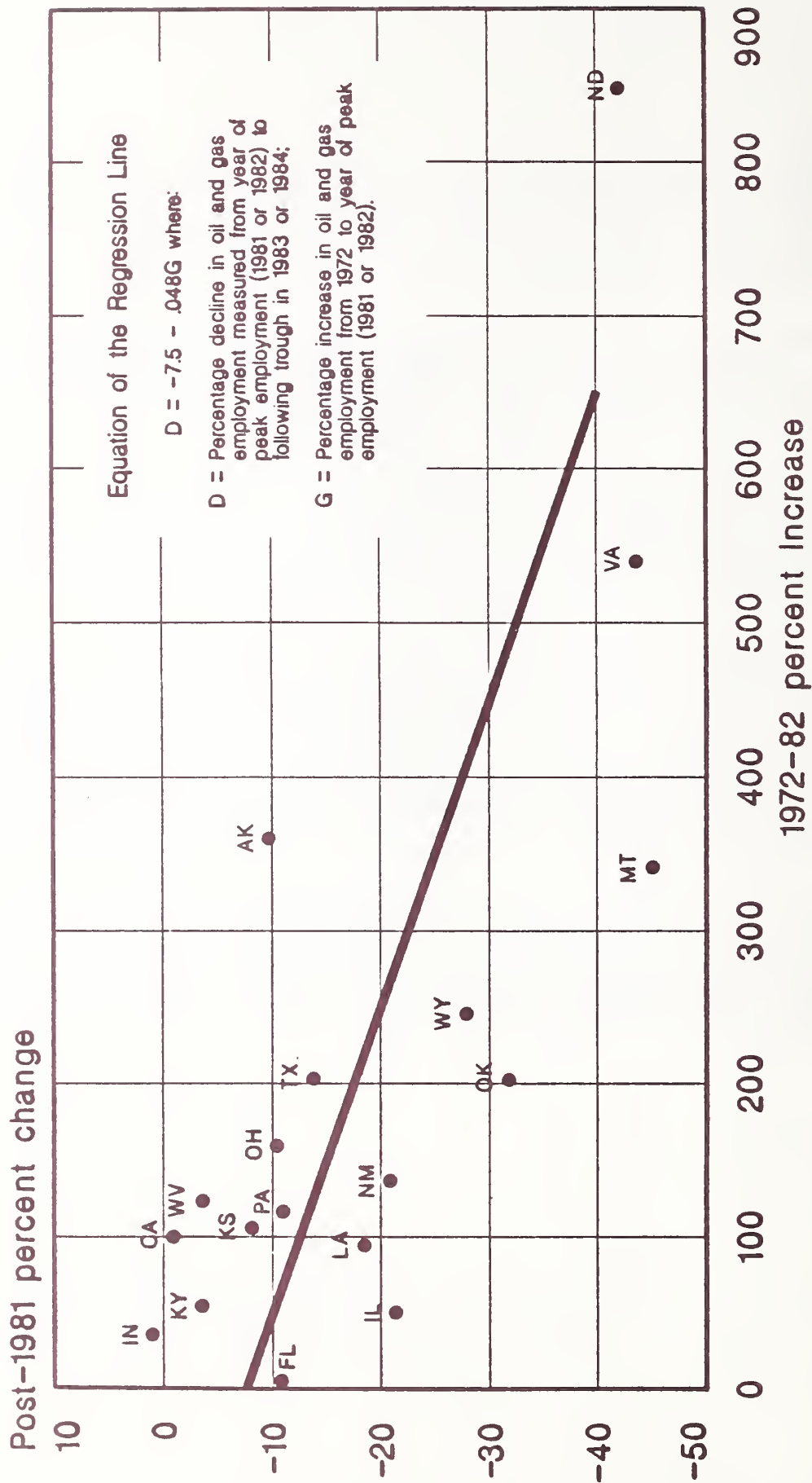
Perhaps the main factor responsible for the furious pace of the oil and gas effort, considering that production did not increase, was that much of that effort was devoted to simply finding the oil and gas deposits; that is, drilling exploratory wells. In view of U.S. dependence on imported oil, which was expected to remain high priced, producers felt confident of a profitable market for all they could produce.

The different oil-producing States varied greatly in their response to rising oil prices. Some States, such as Indiana and California, showed relatively modest increases and subsequent modest decreases in oil and gas extraction employment (10). Others, for example Montana and North Dakota, registered both large increases and large decreases (fig. 2). Drilling in some States may have been extended into marginal areas under very optimistic price expectations, and such operations had to be abandoned when prices were no longer adequate. Those States that showed the largest rate of growth in oil and gas extraction during 1972-81 tended to have the largest rate of decline in the post-1981 period.

There are also wide differences among States in the metro-nonmetro distribution of drilling activity (table 1). In 10 of 18 leading energy States, 50 percent or more of the oil and gas drilling employment was located in nonmetro areas in 1982. Note, however, that in the four States with the largest oil and gas extraction employment, California, Louisiana, Oklahoma, and Texas, most of that employment was located in metro areas.

Figure 2

# **Increase in Gas and Oil Employment in 1972-82** **and Subsequent Decrease**



Source: Unpublished data from the Bureau of Labor Statistics.

Table 1--Share of employment in oil and gas extraction located in nonmetro parts of leading energy States, 1982

State	Nonmetro share	State	Nonmetro share
	<u>Percent</u>		<u>Percent</u>
New Mexico	98	Ohio	50
North Dakota	96	Virginia	47
Indiana	84	Oklahoma	37
West Virginia	75	Louisiana	29
Kentucky	69	Illinois	29
Montana	67	Florida	26
Pennsylvania	63	Texas	26
Wyoming	59	Alaska	19
Kansas	55	California	1

Source: Estimates based on U.S. Bureau of the Census, County Business Patterns, 1982.

#### PAST DEVELOPMENTS IN COAL

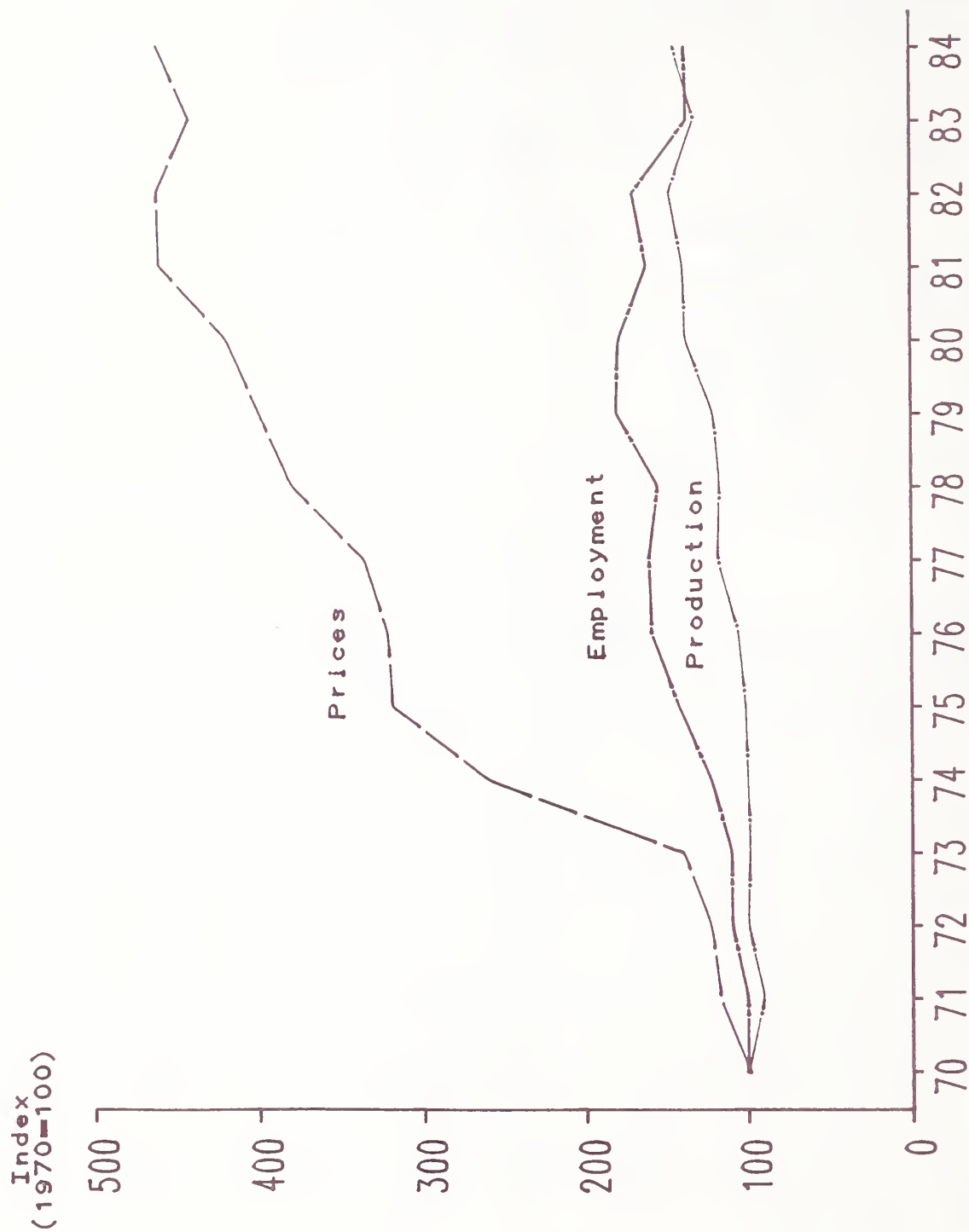
Trends in coal mining employment and production contrast strongly with those in oil and gas extraction. Increases in coal prices and employment were more moderate than was true of oil and gas, but coal production increased while oil and gas production decreased. Coal mining employment peaked in 1979 at 78 percent above the 1972 level, while coal production increased, at first only moderately, then to around 35 percent above the 1970 level (fig. 3).

Employment declined after 1979, while production continued to edge upward, reflecting the increase in labor productivity as production shifted from deep eastern mines to surface mines in the West. Coal mining employment in Kentucky, West Virginia, and Pennsylvania showed substantial post-1979 declines, while employment in other producing States did not.

Unlike oil and gas supplies, ample coal supplies existed in known locations so that little effort had to be devoted to exploration. As a result, coal producers were able to respond rapidly to increases in coal prices. Employment in coal mining rose more rapidly than production until the late seventies, suggesting that favorable price prospects encouraged the exploitation of seams in the East that had previously been considered marginal or submarginal.

Coal also faces a more limited domestic market than does oil. The United States, a net importer of oil, is net exporter of coal. Although coal is a cheaper source of energy than oil or gas, it is not readily substitutable for them in many uses.

Figure 3. Coal Mining Employment, and  
Coal Production and Prices, 1970-84



Source: U.S. Department of Energy and Bureau of Labor Statistics.

## OUTLOOK FOR OIL AND GAS

The United States will probably become increasingly dependent on foreign oil. We have been using oil faster than we have been finding it; our proven reserves have been dropping steadily (6, p. 78). The U.S. Department of Energy's 1983 estimate of known reserves was 27.7 billion barrels (7, p. 79). At recent production rates, these reserves would last only 7 or 8 years. The U.S. Geological Survey's mean 1980 estimate of our "undiscovered recoverable" reserves of crude oil is 82.6 billion barrels, or enough for a little over 20 years more (7, p. 67).

Global reserves are more plentiful in relation to current use than are U.S. reserves. The world uses 18-20 billion barrels of oil annually. The U.S. Geological Survey estimates that proven global reserves are 723 billion barrels of oil, enough for 35-40 years. The USGS "most likely occurrence" figure for world undiscovered reserves is an additional 550 billion barrels, perhaps an additional 25-30 year supply at current use rates (3). Even if these estimates prove pessimistic and if extraction technology continues to advance, the costs of finding and recovering oil will most likely increase substantially.

The sharp decline in oil prices in early 1986 has been caused by a large increase in production. This is in contrast to earlier price weakness which can be largely attributed to a slackening in demand, brought about by substantial improvements in energy-use efficiency and the slow growth of industrial activity in some of the more important oil-importing countries. To argue that oil prices will not resume their climb, though, implies one or more of these developments:

1. The demand for oil will increase slowly, because--
  - o Global economies will not grow as rapidly as in the past; and
  - o Continued improvements in the efficiency of energy use will depress the overall growth in demand for petroleum products.
2. The supply of oil or oil substitutes will increase because--
  - o Large and reasonably accessible new reserves of oil will be found, or radical new technology will be developed to more economically exploit old reserves; and
  - o Other energy sources, such as clean-burning coal, oil-to-gas conversion, nuclear power (fission and, eventually, fusion), and solar energy, will be produced at reasonable costs.

Probably the ultimate solution to the energy problem will come through large-scale development of alternative energy sources. But in the absence of a dramatic technological breakthrough, such a development is likely only at somewhat higher energy prices.

Whether we will see another boom-and-bust cycle in oil remains to be seen, but there are several reasons to expect that the next cycle, if it occurs, will be much less pronounced than the current one.

1. The United States is now less dependent on oil, especially on OPEC oil:
  - o In 1977, almost 50 percent of U.S. energy came from oil; in 1984, oil's share had dropped to less than 42 percent;
  - o In 1977, almost 52 percent of U.S. oil supplies were imported. By 1984, imports had dropped to less than 38 percent (6, p. 5); and
  - o In 1977, over 70.3 percent of U.S. oil imports came from OPEC countries; in 1984, that share had dropped to less than 38 percent (6, p. 95).
2. High energy costs have led to greater energy conservation worldwide. In the cheap-energy days before the oil embargo, energy was used liberally in the United States. U.S. annual per capita use rose from about 200 million British thermal units (Btu's) in 1949 to about 350 million Btu's in the midseventies. The second oil shock in 1979 brought U.S. use down to a little over 300 million Btu's in 1984 (5, p. 46). As energy prices increased, producers and consumers substituted other resources for energy.

In terms of economic activity, our energy use from 1949-72 fluctuated around 60,000 Btu's per 1972 dollar of gross national product (GNP), then dropped steadily to around 45,000 in 1984 (6, p. 47). Whether this trend will continue, no one can say with certainty, but there appear to be ample opportunities for further conservation of energy.
3. If and when oil supplies begin to tighten again, the OPEC countries will probably use whatever market power they have left in a much more cautious manner than they did in the seventies. Also, other exporting countries, having seen how badly OPEC overplayed its hand, will be equally cautious.
4. In the past 10 years, known reserves of natural gas worldwide have doubled. The petroleum industry is increasingly looking for gas, where previously it was primarily interested in oil (9). Because of the high costs of shipping gas overseas, these reserves may not benefit the United States directly, but they make other countries less dependent on oil, and thus take some of the demand pressure off world oil supplies.
5. Substantial amounts of oil could be replaced by natural gas in stationary uses. In 1983, the United States used some 15.9 million barrels of oil products per day, 5.9 million barrels (about 38.8 percent) of it in stationary residential, commercial, and industrial uses. The other 10 million barrels was used in transportation. The American Gas Association (AGA) has published the following estimates:
  - o Conversion from oil to gas in stationary uses could replace 730,000 barrels of oil per day (about 14.4 percent of 1983 daily imports) within 1 year. Within 5 years, oil-to-gas conversion could replace 1.83 million barrels of oil per day, or about 36 percent of current imports (2).

- o The oil-to-gas substitution potential in transportation is more limited. The AGA estimates that by 1990 some 2.8 million vehicles (mostly in fleets) could be converted to natural gas. This would save some 250,000 barrels of gasoline daily, or about 3 percent of 1983 gasoline consumption.

The U.S. Department of Energy has projected that oil prices will bottom out in 1986, then resume their rise, reaching a level some 22 percent above their 1981 peak (in 1983 dollars) by the midnineties (5, p. 12). This increase is quite modest compared with those of the seventies, and recent oil price developments do not suggest higher prices in the very near future.

#### OUTLOOK FOR COAL

The United States has plentiful supplies of coal, but the usefulness of these supplies in the event of another energy shortage is unclear. Industry has made good progress in developing processes that make coal burning much cleaner. If reasonably economical, such processes could greatly reduce "acid rain," but the use of coal as an industrial and electric power fuel still might not increase. Another perhaps much more important factor is that coal supplies are not located where the electric power is most needed. The cost of shipping the coal or transmitting the electric power may deny coal-produced power to some parts of the country, even without environmental restraints (8).

#### OUTLOOK FOR NUCLEAR ENERGY

The production of nuclear power in the United States increased fivefold between 1972 and 1984, when it accounted for 14 percent of our total electric power production. The U.S. Department of Energy's projection, based on the most probable set of assumptions, calls for a further increase in 1984-90 of 54 percent, and an additional 6.5 percent by 1995. These projections assume that any cancellation of nuclear plants scheduled for operation by 1995 will be offset by reactivation of mothballed construction projects. DOE's projected growth rates for Canada, Europe, and the Far East are considerably higher than those for the United States. This projected growth could benefit the United States by decreasing the demand for world oil supplies (4).





#### REFERENCES

1. Abelson, Philip H. "World Supplies of Natural Gas," Science, Vol. 228, No. 4705, June 14, 1985.
2. American Gas Association. The Strategic Role of Gas in Replacing Imported Oil. Policy Evaluation and Analysis Group Report 1984-10. Washington, DC, June 29, 1984.
3. Masters, Charles D. Distribution and Quantitative Assessment of World Crude Oil Reserves and Resources. Open File Report 83-728. U.S. Dept. of Int., Geological Survey, 1983.
4. U.S. Department of Energy, Energy Information Administration. Commercial Nuclear Power: Prospects for the United States and the World. DOE/EIA-0438 (85). 1985.
5. \_\_\_\_\_. Annual Energy Outlook, 1984. DOE/EIA-0383 (84). Jan. 1985.
6. \_\_\_\_\_. Annual Energy Review, April 1984. DOE/EIA-0035 (84). Apr. 1985.
7. \_\_\_\_\_. Monthly Energy Review, May 1985. DOE/EIA-0035 (85/05). Aug. 1985.
8. \_\_\_\_\_. Fuel Choice in Steam Electric Generation: Historical Overview. DOE/EIA-0472. Aug. 1985.
9. U.S. Department of Labor, Bureau of Labor Statistics. Employment and Earnings, 1949-78. Bulletin 1312-1, 1979 and Supplements.
10. Unpublished employment data from the Bureau of Labor Statistics, 1970-84.